

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	IB Docket No. 02-10
Procedures to Govern the Use of Satellite)	
Earth Stations on Board Vessels in the 5925-)	
6425 MHz/3700-4200 MHz Bands and 14.0-)	
14.5 GHz/11.7-12.2 GHz Bands.)	

To: The Commission

**PETITION FOR PARTIAL CLARIFICATION
OR RECONSIDERATION OF
THE BOEING COMPANY**

R. Craig Holman
Counsel
The Boeing Company
Connexion by Boeing
P.O. Box 3707, MC 14-07
Seattle, WA 98124-2207
(206) 655-5399

Philip L. Malet
Carlos M. Nalda
Lee C. Milstein
Steptoe & Johnson LLP
1330 Connecticut Avenue, NW
Washington, DC 20036
(202) 429-3000
Counsel for The Boeing Company

March 2, 2005

SUMMARY

The Boeing Company (“Boeing”), licensee of the Ku-band Connexion by BoeingSM system, hereby files this Petition for Partial Reconsideration or Clarification in this proceeding establishing rules governing the use of earth stations on board vessels (“ESVs”). Specifically, Boeing requests clarification or reconsideration of the Commission’s conclusions with respect to the following issues.

First, Boeing urges the Commission to reconsider its decision to limit U.S.-licensed ESV operations to the routine off-axis e.i.r.p. levels adopted in the *ESV Order*, which reflect Commission’s two-degree spacing limits, regardless of the coordinated parameters of the serving satellite. Unnecessarily restricting ESV transmissions to these levels, particularly in regions where two-degree spacing is not the norm, places U.S. ESV operators at a significant competitive disadvantage vis-à-vis their foreign counterparts and undermines the quality of ESV service provided to U.S. vessel operators.

Second, Boeing requests clarification or reconsideration of the methodology for calculating the aggregate off-axis e.i.r.p. density of simultaneously transmitting ESVs. Although the *ESV Order* suggests that the off-axis e.i.r.p. density levels adopted by the Commission limit the aggregate power received at the neighboring satellites from all simultaneously transmitting ESVs, the text of the applicable rule gives no indication that power density limits are aggregate limits. Further, the Commission should clarify how individual ESV transmissions may be taken into account in meeting the aggregate levels. Clarification of this issue is necessary to afford ESV systems the operational flexibility needed to implement bandwidth-on-demand systems and dynamically allocate power to individual ESV terminals based on the capacity requirements of those terminals.

Third, Boeing requests that the Commission modify the ESV tracking requirement adopted in the *ESV Order* to reflect available ESV tracking technologies and current trends in ESV regulation. In particular, the response time associated with terminating ESV transmissions after a tracking accuracy exceedance may be unrealistic for common ESV tracking methods and given the latency associated with communications between subsystems within an ESV system.

Finally, Boeing requests reconsideration of the establishment of a uniform 300 km distance for prior agreement for foreign-licensed C-band and Ku-band ESV operations. This distance is inappropriate for Ku-band ESV operations given that the minimum distance in Resolution 902 for Ku-band is 125 km. In addition, requiring prior agreement for Ku-band ESV operations throughout the 14.0-14.5 GHz band appears to be inconsistent with Resolution 902 because the United States is a “concerned administration” with respect to the 14.4-14.5 GHz band only.

As discussed below, clarification or reconsideration of these issues would be consistent with the Commission’s policies and objectives in this proceeding, and is essential to permit U.S.-licensed ESV operators to compete effectively on a global basis.

TABLE OF CONTENTS

SUMMARY	i
I. THE COMMISSION SHOULD PERMIT KU-BAND ESVS TO OPERATE AT HIGHER POWER LEVELS IN ACCORDANCE WITH THE COORDINATED PARAMETERS OF THEIR SERVING SATELLITES.....	3
A. The Record of this Proceeding and the Commission’s Decision.....	4
B. Ku-Band ESVs Should Be Permitted To Operate in Accordance with the Coordinated Parameters of their Serving Satellites	6
1. Higher-Power ESV Operations in Regions Where Two-Degree Spacing is Not the Norm.....	8
2. Coordination of Higher-Power ESV Operations with Adjacent Satellite Operators in a Two-Degree Spacing Environment.....	12
3. U.S. ESV Applicants Should Be Permitted To Establish Consistency with Coordinated Parameters by Submitting a Certification of Compliance from the Serving Satellite Operator	14
II. THE COMMISSION SHOULD CLARIFY THE CALCULATION OF AGGREGATE OFF-AXIS E.I.R.P. DENSITY OF ESV TRANSMISSIONS	16
III. THE COMMISSION SHOULD MODIFY THE RESPONSE TIME ASSOCIATED WITH TERMINATING ESV TRANSMISSIONS AFTER A TRACKING ACCURACY EXCEEDANCE	18
IV. THE COMMISSION SHOULD ESTABLISH A KU-BAND MINIMUM DISTANCE AND APPLICABLE FREQUENCY BANDS FOR PRIOR AGREEMENT CONSISTENT WITH RESOLUTION 902	22
V. CONCLUSION.....	25

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	IB Docket No. 02-10
Procedures to Govern the Use of Satellite)	
Earth Stations on Board Vessels in the 5925-)	
6425 MHz/3700-4200 MHz Bands and 14.0-)	
14.5 GHz/11.7-12.2 GHz Bands.)	

To: The Commission

PETITION FOR PARTIAL CLARIFICATION OR RECONSIDERATION

The Boeing Company (“Boeing”), by its attorneys and pursuant to Section 1.429 of the Commission’s Rules,¹ hereby files this Petition for Partial Reconsideration or Clarification (“Petition”) in the above-captioned proceeding regarding the use of earth stations on board vessels (“ESVs”).² Boeing is the leading proponent of advanced broadband aeronautical communications services through its Connexion by BoeingSM (“Connexion”) Ku-band Aeronautical Mobile-Satellite Service (“AMSS”) offering.

As the Commission is aware, Boeing announced the expansion of its Connexion service to the maritime market in January 2004,³ and Boeing currently is conducting limited Ku-band

¹ 47 C.F.R. § 1.429.

² See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, *Report and Order*, IB Docket No. 02-10, FCC 04-286 (rel. Jan. 6, 2005) (“*ESV Order*”).

³ The Boeing Company, New Release: Connexion by Boeing Expands Service Offering to Include Maritime Communications (Jan. 13, 2004) (available at <<http://connexion.web.boeing.com/CBBint/connexionNewsArticle.cfm?id=8377>>).

ESV operations under experimental authority.⁴ Using Connexion terminals specifically developed for the maritime market, Boeing will leverage the satellite and ground-based network of the Connexion system to offer vessel operators and their passengers and crew a full range of communications capabilities, including high-speed Internet and corporate intranet communications, voice and videoconferencing, data and fax services, remote monitoring of ship systems and cargo, satellite television programming and other services.

Boeing greatly appreciates the Commission's efforts to facilitate the provision of satellite-delivered broadband maritime communications services, and believes that the *ESV Order*, for the most part, establishes an appropriate balance between the interests of ESV operators and other users of the spectrum. However, certain elements of the *ESV Order* require further consideration or clarification to ensure that the regulatory regime established by the Commission more fully advances its goals for market-driven deployment of satellite-based broadband technologies in the maritime sector.⁵ Specifically, Boeing requests clarification or reconsideration of the following issues:

- (i) off-axis e.i.r.p. levels of ESV transmissions that are overly restricted to the routine licensing values established in the *ESV Order*, which reflect Commission's two-degree spacing limits, regardless of the coordinated parameters of the serving satellite;
- (ii) the methodology for calculating the aggregate off-axis e.i.r.p. of simultaneously transmitting ESVs;
- (iii) the response time associated with ESV tracking accuracy exceedance; and
- (iv) the establishment of a 300 km demarcation line for prior agreement for foreign-licensed Ku-band ESV operations

⁴ See, Experimental Temporary Authorization, File No. 0703-EX-ST-2004, Call Sign WD2XFK (eff. Dec. 13, 2004).

⁵ See *ESV Order* at ¶ 4.

throughout the entire 14.0-14.5 GHz band, even though the minimum distance in the applicable ITU Resolution for Ku-band ESV operations is only 125 km and the United States is only a “potentially concerned administration” with respect to the 14.4-14.5 GHz band.

As discussed below, clarification or reconsideration of these issues would be consistent with the Commission’s policies and objectives in this proceeding, and is essential to permit U.S.-licensed ESV operators to compete effectively on a global basis.⁶

I. THE COMMISSION SHOULD PERMIT KU-BAND ESVS TO OPERATE AT HIGHER POWER LEVELS IN ACCORDANCE WITH THE COORDINATED PARAMETERS OF THEIR SERVING SATELLITES

In its prior comments in this proceeding,⁷ Boeing proposed that the Commission license Ku-band ESV operations on the basis of off-axis e.i.r.p. density levels. Specifically, Boeing suggested that the aggregate off-axis e.i.r.p. levels along the geostationary arc for co-polarized signals of Ku-band ESVs should not exceed the off-axis e.i.r.p. levels produced by routinely licensed Ku-band VSAT terminals.⁸ The Commission adopted this licensing approach along with ESV blanket licensing procedures that reflect these VSAT routine licensing values.⁹

Boeing further proposed that Ku-band ESV systems should have the flexibility to operate at power levels in excess of the blanket licensing values in two circumstances: (i) for operations

⁶ Because Boeing proposes to provide Connexion maritime communications services only in the Ku-band, this Petition addresses the Commission’s rules and policies with respect to regulation of ESVs in that spectrum. However, certain issues raised herein may be applicable to C-band ESV operations as well (*e.g.*, imposition of U.S. two-degree spacing limits and calculation of aggregate off-axis e.i.r.p. levels for ESV systems).

⁷ See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, *Comments of the Boeing Company*, IB Docket No. 02-10 (filed Feb. 24, 2004) (“*Boeing Comments*”).

⁸ *Id.* at 19-20.

⁹ See *ESV Order* at ¶¶ 98-101; see also 47 C.F.R. § 25.134(a) (1), and (b).

with satellites in regions where two-degree satellite spacing is not the norm and operator-to-operator coordination is relied on to establish adjacent satellite interference limits; and (ii) where ESV transmissions in excess of the off-axis e.i.r.p. values can be coordinated with adjacent satellite operators in a two-degree spacing environment, subject to an additional technical showing and the rights of future Ku-band licensees to require compliant operations.¹⁰ In addressing this Boeing proposal, the Commission simply stated:

We disagree with Boeing's assertion that Ku-band ESV operators should be allowed to coordinate uplink transmissions with adjacent satellite operators in excess of the limits described above, up to the limits contained in ITU-R Resolution 902 While we recognize that other administrations operate under a three-degree FSS spacing regime and may, therefore, permit higher off-axis power limits, to operate with satellites licensed by the Commission, we expect U.S.-licensed FSS space station operations to meet the off-axis e.i.r.p.-density limits contained in Section 25.222 of the Commission's rules.¹¹

As discussed below, the public interest would be better served by not overly restricting U.S.-licensed Ku-band ESV transmit power levels where the serving satellite has coordinated off-axis e.i.r.p. levels in excess of the ESV routine licensing values.

A. The Record in this Proceeding and the Commission's Decision

While the *ESV Order* attempts to address Boeing's proposal, it does not appear to consider it substantively or provide any rationale for the Commission's decision not to allow for higher ESV power levels under any circumstances.¹² Rather, the discussion in the *ESV Order*

¹⁰ *Boeing Comments* at 20-21.

¹¹ *ESV Order* at ¶ 101. Boeing assumes that the reference to "U.S.-licensed FSS space station operations" should read "U.S.-licensed ESV operations."

¹² Boeing acknowledges that the issue of ESV operations in excess of the routine licensing off-axis e.i.r.p. levels was not extensively addressed in this proceeding by interested parties, and that there is limited information in the record regarding the public interest reasons

merely indicates that the Commission disagrees with Boeing's proposal and expects ESV operators to meet the off-axis e.i.r.p. levels contained in the Rules without explaining the basis for the Commission's decision as required by well-established principles of administrative law.¹³

The Commission's summary treatment of Boeing's proposal may result from certain unstated assumptions regarding Ku-band ESV licensing. For example, the Commission may view higher-power ESV operations as inconsistent with a designation of ALSAT authority afforded to U.S. ESV licensees¹⁴ because the ability to operate with all U.S.-licensed satellites (and foreign-licensed satellites on the Permitted Space Station List) generally assumes compliance with routine-licensing power levels.¹⁵ While this may be true, the *ESV Order* does not appear to recognize that individual satellites, with operating parameters specific to those satellites, are routinely authorized as additional points of communication for earth station

for adopting Boeing's proposal. Although Boeing believes that the existing record is sufficient to support adoption of its proposal, to the extent the legal and policy arguments supporting Boeing's proposal are considered to be "new facts," Boeing respectfully requests that the Commission find that consideration of all information provided in connection with this Petition is in the public interest pursuant to Section 1.429(b)(3) of the Commission's Rules. *See* 47 C.F.R. § 1.429(b)(3).

¹³ *See, e.g., Puerto Rico Higher Educ. Assistance Corp. v. Riley*, 10 F.3d 847 (DC Cir. 1993) (criticizing agency's failure to provide a reasoned basis for its decision and finding that without this, it could not determine whether the agency had fully considered the issues, despite an ultimate holding that the plaintiff had not made a convincing argument); *Inova Alexandria Hosp. v. Shalala*, 244 F.3d 342 (4th Cir. 2001) ("[T]he agency must provide an adequate explanation for its actions, and the explanation must show a rational connection between the facts found and the choice made.") (internal citations omitted).

¹⁴ *ESV Order* at ¶ 105.

¹⁵ ALSAT authority allows an earth station operator providing FSS services in the conventional C- and Ku-bands to access any U.S.-licensed satellite or any satellite on the Permitted Space Station List without additional Commission action, provided that those communications fall within the same technical parameters and conditions established in the earth station license. *See Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States, First Order on Reconsideration*, 15 FCC Rcd. 7210-11, 7215-16 (1999).

licenses in other services.¹⁶ It is in this context – authorizing ESV system communications with individual satellites – that the possibility of higher-power ESV operations should be addressed.

The Commission’s decision also may be based, in part, on the notion that the *ESV Order* seeks to impose the same operational limitations, including compliance with the routine off-axis e.i.r.p. density values, on all U.S. ESV licensees and foreign-licensed ESVs communicating with U.S. hubs.¹⁷ However, limitations on the Commission’s jurisdiction preclude application of such requirements to all ESV operations, such as those by foreign-licenses operators in other regions of the world.¹⁸ As a result, the Commission’s decision substantially and unnecessarily disadvantages U.S. ESV licensees vis-à-vis their foreign-licensed counterparts. The Commission can effectively address these issues by adopting Boeing’s proposal to permit higher-power ESV operations in certain circumstances, as described more fully below.

B. Ku-Band ESVs Should Be Permitted To Operate in Accordance with the Coordinated Parameters of their Serving Satellites

The Commission’s earth station licensing rules are generally designed to promote operational flexibility and interference-free operation in a two-degree spacing environment.¹⁹ In

¹⁶ Of course, the ability to obtain authority to communicate with individual satellites is essential to permit global U.S.-licensed ESV operations (*e.g.*, providing service in other regions of the world using foreign satellites not on the Permitted Space Station List), and the Commission presumably did not seek to limit this possibility when it granted ESV operators ALSAT authority.

¹⁷ *See ESV Order* at ¶¶ 99, 124-126.

¹⁸ *Id.* at ¶ 122.

¹⁹ The FCC has adopted a VSAT licensing regime that allows operators to deploy terminals throughout the U.S. pursuant to a blanket earth station license. *See*, 47 C.F.R. § 25.134(a) (1) & (b); In the Matter of Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands, *Declaratory Order*, 1986 WL 291567, ¶6 (rel. Apr. 9, 1986) (“*VSAT Order*”) (“A blanket authorization procedure is consistent with the public interest in that it will substantially reduce administrative costs and delays.”). The Commission’s ALSAT designation, a designation available to VSAT operators and ESV

addition, the Commission has sought to streamline its earth station licensing rules to reduce the administrative burden and delay associated with processing individual earth station applications.²⁰ Even where the Commission has adopted blanket licensing of earth stations in other services pursuant to routine licensing provisions to further the foregoing objectives, however, the Commission has sought to preserve the ability of earth station licensees to operate in a manner inconsistent with the routine licensing provisions so long as there would be no adverse interference impact on adjacent satellite operations.²¹

In this context, the Commission's decision to prohibit entirely Ku-band ESV licensees from coordinating higher transmit power levels is an unusual and unexplained departure from the otherwise pro-competitive and deregulatory approach to ESV licensing adopted in the *ESV Order*. This divergence is particularly striking because the approach to controlling adjacent satellite interference embodied in the Ku-band ESV rules is based on the Commission's VSAT rules, which expressly permit VSATs to operate within the United States at power levels in

operators, allows earth station operators to point terminals at any permitted satellite without requiring separate applications. *See*, In the Matter of Streamlining the Commission's Rules and Regulations for Satellite Application and Licensing Procedures, *Report and Order*, 11 FCC Rcd 21581, ¶ 42 (rel. Dec. 16, 1996) ("We allow applicants to use the designation "ALSAT" to provide them with the flexibility to access a variety of satellites without the delays associated with obtaining additional regulatory approval to do so.").

²⁰ *See, e.g.*, In the Matter of 2000 Biennial Regulatory Review--Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Notice of Proposed Rulemaking*, 15 FCC Rcd 25128 (2000) ("Over the years, we have taken action to streamline our satellite and earth station licensing rules and procedures when warranted..."); Commission Launches Earth Station Streamlining Initiative, *Public Notice*, DA 99-1259, 14 FCC Rcd 9834 (rel. June 25, 1999); International Bureau To Streamline Satellite And Earth Station Processing, *Public Notice*, Report No. SPB-140, 1998 FCC LEXIS 5577, rel. Oct. 28, 1998.

²¹ *See, e.g.*, 47 C.F.R. §§ 25.134(b), 25.138(b).

excess of the routine licensing values, subject only to an additional technical showing and the rights of future Ku-band licensees to require compliant operations in certain circumstances.²²

While there may be some differences between Ku-band ESV operations and VSAT operations from an interference perspective, there is no technical reason to prohibit Ku-band ESV operators from coordinating higher power levels with adjacent satellite operations -- particularly for ESV communications with satellites in regions where two-degree spacing is not prevalent. Thus, in addition to allowing for operation with ALSAT satellites in accordance with the routine licensing of off-axis e.i.r.p. density levels, Ku-band ESV systems should have the flexibility to transmit at higher power levels up to the levels included in Resolution 902, in the following circumstances: (i) for operations in regions where two-degree spacing is not the norm and operator-to-operator coordination is relied on to establish adjacent satellite interference limits; and (ii) where ESV transmissions in excess of the routine off-axis e.i.r.p. values can be coordinated with adjacent satellite operators in a two-degree spacing environment. Each of these circumstances is addressed separately below.

1. Higher-Power ESV Operations in Regions Where Two-Degree Spacing is Not the Norm

In Europe and Asia, where three-degree spacing is the norm, the routine power levels for Ku-band ESVs and VSATs are 8 dB higher than the levels set forth in new Section 25.222 of the Rules. Indeed, Resolution 902, which sets forth technical and operational requirements for Ku-band ESV operations, specifies the routine off-axis e.i.r.p. density levels for ESV transmissions in a three-degree spacing environment as the maximum levels to ensure compatibility with other

²² See 47 C.F.R. § 25.134(b). The Commission's Ka-band earth station blanket licensing rules contain similar provisions regarding the coordination of higher off-axis e.i.r.p. values. See 47 C.F.R. § 25.138(b).

FSS networks.²³ Although internationally recognized requirements such as Resolution 902 apply, control of adjacent satellite interference is typically addressed through operator-to-operator coordination agreements in other regions. Thus, unlike the traditional U.S. domestic arc where the Commission's rules facilitate interference-free earth station operations with U.S.-licensed satellites (and foreign-licensed satellites on the Permitted Space Station List) without the need for coordination, parameters governing earth station operations with satellites in other regions are generally established through the coordination process between neighboring satellites authorized by different national Administrations.

Given the unique technical characteristics associated with individual satellites in other regions, Boeing proposed that ESV operators should be allowed to operate at higher power levels by demonstrating compliance with the off-axis e.i.r.p. limits set forth in Resolution 902 and obtaining a certification from their satellite providers that the aggregate off-axis e.i.r.p. density levels produced by all co-frequency ESVs communicating with the serving satellite will be no greater than the interference levels that have been accepted by adjacent satellite systems through the coordination process.²⁴ The *ESV Order* does not directly address ESV operations with satellites in a non-two degree spacing environment, such as foreign-licensed satellites serving other regions of the world. Although it notes that other Administrations may implement their respective FSS systems under a three-degree spacing regime and may therefore permit higher off-axis e.i.r.p. power densities, the Commission states that it expects U.S.-licensed ESV operations to meet its off-axis e.i.r.p.-density limits “to operate with satellites licensed by the

²³ See Resolution 902 (Geneva, 2003) at Annex 2. These values were developed for implementation globally for Ku-band satellites with 3-degree spacing, and are equivalent to the limits established by the ITU for the maximum permissible level of off-axis e.i.r.p. density from Ku-band VSATs. See Recommendation ITU-R S.728-1 at *Recommends 1*.

²⁴ See *Boeing Comments* at 20-21.

Commission.”²⁵ This limiting language suggests a focus on the two-degree spacing environment in the context of ALSAT authority, rather than an explicit rejection of the possibility of operating at higher power levels where two-degree spacing is not prevalent.

It is critical for U.S. ESV licensees to be able to operate with satellites in other regions of the world at power levels consistent with ITU requirements and the coordinated parameters of their serving satellite. Although the levels may be higher than the routine licensing levels established by the Commission for a two-degree spacing environment, they are in fact routine for the orbital environment in which these satellites operate. And, of course, by limiting U.S.-licensed Ku-band ESV operations to the levels accepted by neighboring satellites in the context of formal coordination, the possibility of unacceptable or harmful interference to adjacent satellite operators is remote.

Unnecessarily restricting the transmit power levels of U.S. ESV transmissions operating with satellites in other regions would severely handicap U.S.-licensed ESV operations. In particular, the Commission’s ESV rules do not apply to ESVs on foreign-registered vessels communicating with non-U.S. hubs,²⁶ but do apply to ESVs on U.S.-registered vessels regardless of the location of the vessel. This regulatory disparity would substantially undermine the ability of U.S. ESV licensees to compete effectively in regions where two-degree spacing is not prevalent because, unlike their foreign competitors, they would be restricted to operating at the lower U.S. routine power levels.

²⁵ *ESV Order* at ¶ 101.

²⁶ *See ESV Order* at ¶¶ 99, 124-128. Indeed, as a result of jurisdictional limitations, the Commission’s rules would not appear to apply to ESVs installed on foreign-registered vessels by U.S. ESV operators when those ESVs communicate with hubs located outside the United States. *Id.*

For example, under the current rules, a U.S.-registered vessel equipped with a Connexion maritime terminal operating in the Pacific Ocean and communicating with a hub earth station in Japan would still be limited to the U.S. off-axis e.i.r.p. density levels, whereas a Japanese vessel operating in the same location using the same satellite and hub earth station could transmit up to 8 dB higher so long as it complied with the coordinated parameters of the serving satellite. In addition, it is possible for a U.S.-licensed ESV operating in or near the United States to communicate with Atlantic or Pacific Ocean region satellites located outside the traditional U.S. domestic arc that have been coordinated to higher off-axis e.i.r.p. levels (*e.g.*, FCC-licensed Intelsat satellites). In such circumstances, restricting U.S.-licensed ESVs to the routine licensing power levels would do nothing to protect adjacent satellites from potential interference, but rather would serve only to disadvantage U.S. ESV licensees.²⁷

The adverse effects of imposing two-degree spacing transmit power limits in a three-degree spacing environment are significant in terms of system capacity, which diminishes the quality of service to end-users during busy periods and imposes substantial additional costs on ESV system operators. The impact on system capacity varies with antenna size and the modulation scheme used. For a 1-meter antenna using CDMA, the penalty in terms of transponder capacity loss is approximately 25-40 percent. For a 1-meter antenna using TDMA, the penalty could be as high as two to three times the amount of transponder capacity required to serve the same number of vessels. A similar capacity penalty would be imposed on Connexion's

²⁷ While the circumstances in which the U.S. ESV licensees are handicapped may be a defined subset of the entire maritime market (*i.e.*, U.S.-registered vessels wherever they may be located and foreign-registered vessels communicating with hubs located in the United States), that subset is nonetheless significant in view of the communications needs of U.S.-registered vessels (*e.g.*, U.S. Navy ships) and the maritime traffic that would potentially communicate with U.S.-licensed ESV systems operating with hubs located in the United States.

AMSS operations if it is forced to operate consistent with the Commission's Ku-band routine licensing values in other regions of the world.²⁸

Given that the goals of this proceeding include promoting the market-driven deployment of U.S. ESV operations and establishing a level regulatory playing field, it is incongruous that the Commission would so severely handicap the international operations of U.S. ESV licensees without any concomitant benefits. Thus, Boeing urges the Commission to reconsider its decision and permit U.S.-licensed ESVs to operate with higher off-axis e.i.r.p. density levels consistent with Resolution 902 and the coordinated parameters of the serving satellites in regions where two-degree spacing is not the norm.

2. Coordination of Higher-Power ESV Operations with Adjacent Satellite Operators in a Two-Degree Spacing Environment

Separate from the opportunity to operate at higher power in regions where two-degree spacing is not the norm is a U.S. ESV licensee's ability to coordinate higher-power operations in a two-degree spacing environment. Boeing strongly supports the Commission's decision to grant ALSAT authority to Ku-band ESV operators and acknowledges that ESV licensees seeking to operate under ALSAT authority must limit the off-axis e.i.r.p. of ESV transmissions to the levels set forth in new Section 25.222 of the Rules in a two-degree spacing environment. In certain circumstances, however, it may be necessary or appropriate for ESV licensees to supplement ALSAT operations with authority to communicate at higher power levels with

²⁸ Given the commonality of network control functions and satellite and ground infrastructure for its AMSS and ESV operations, Connexion will be forced to address the complex issues associated with potentially controlling several different types of services to different off-axis e.i.r.p. levels. This may require controlling all operations at the same reduced levels. Even assuming the engineering and software development issues can be overcome (which itself would involve substantial expense, complexity and delay), the capacity penalty on ESV operations would still be significant. Indeed, all global U.S. ESV operators will have to struggle with the operational complications and penalties associated with restricting only ESV transmit operations on U.S.-registered vessels to the two-degree spacing levels.

individual U.S. or foreign-licensed satellites even though they may be operating in a two-degree orbital spacing environment. For example, a satellite may already have coordinated higher transmit power levels for its associated earth stations, and ESV operations at those higher levels may have no adverse impact on neighboring satellites while substantially enhancing service to ESV customers.

The Commission's analogous VSAT rules allow for the possibility of higher-power operations subject to the consent of existing and future satellite operators that are potentially affected by such operations. The Commission similarly should permit higher-power Ku-band ESV operations subject to requirements that protect the interests of potentially affected satellite operators. In this connection, ESV applicants seeking to operate at off-axis e.i.r.p. levels in excess of those defined in new Section 25.222 of the Rules should be required to submit:

- (i) link budget analyses of the operations proposed along with a detailed explanation of how each uplink and downlink carrier density figure is derived;
- (ii) a narrative summary indicating whether there are margin shortfalls in any of the current baseline services as a result of the addition of the applicant's higher-power service, and if so, how the applicant intends to resolve those margin shortfalls; and
- (iii) a certification that all potentially affected parties (*i.e.*, Ku-band GSO FSS satellite networks within +/- 6 degrees of the serving satellite) acknowledge and do not object to the use of the applicant's higher power levels.²⁹

²⁹ With respect to establishing the acknowledgement and non-objection of potentially affected satellite operators, the Ku-band VSAT rule requires "proof by affidavit" whereas the subsequently adopted Ka-band rules require only an applicant certification. *Compare* 47 C.F.R. § 25.134(b) *with* 47 C.F.R. § 25.138(b). Boeing proposes the certification approach for ESV operations because it reflects a more recent Commission view of the subject and in many cases Ku-band satellite operators have already coordinated higher-power levels so obtaining a new affidavit would be unnecessary.

In addition, like VSAT networks authorized to operate at higher power, Ku-band ESV systems authorized to operate at off-axis e.i.r.p. levels in excess of the routine licensing values should bear the burden of coordinating with any future applicants or licensees that propose compliant Ku-band operations that may be adversely affected by such higher-power operations. If no good faith coordination agreement can be reached, the higher-power ESV licensee must reduce its power density levels to the routine licensing levels.³⁰ This requirement ensures that future Ku-band licensees can utilize the spectrum consistent with the Commission's routine licensing rules.

By permitting higher-power Ku-band ESV operations in the manner proposed by Boeing, the Commission can preserve operational flexibility for ESV licensees while fully protecting the interests of potentially affected parties. In addition, such an approach would ensure more consistent regulatory treatment for Ku-band VSAT and ESV operations – FSS satellite services that have similar capabilities and characteristics, and share a common interest in appropriately managing the Ku-band interference environment because they use the same FSS satellites to provide service.

3. U.S. ESV Applicants Should Be Permitted To Establish Consistency with Coordinated Parameters by Submitting a Certification of Compliance from the Serving Satellite Operator

U.S. ESV applicants should be able to establish consistency with applicable coordination agreements by filing a certification from the serving satellite operator that any higher-power off-axis e.i.r.p. levels have been accepted by adjacent satellite systems through the coordination process. Such a certification would provide confirmation that the proposed power levels have been coordinated, and ensure that the ESV licensee and its satellite operator can be held

³⁰ See 47 C.F.R. § 25.134(c); *see also* 47 C.F.R. § 25.138(c).

accountable for their representations in the context of ESV licensing. This approach is also necessary given the realities of operating with foreign satellites in accordance with parameters established in operator-to-operator coordination agreements.

First, coordination agreements are typically confidential and closely guarded by satellite operators. Foreign satellite operators cannot be expected to submit coordination agreements to the Commission simply for purposes of verification of ESV operations, and the Commission would not countenance submission of U.S. coordination agreements to foreign administrations in a similar context. Thus, direct examination of applicable coordination agreements is not possible.

Second, alternatives such as obtaining an affidavit from adjacent satellites operators are not workable. The adjacent operator, who is essentially a disappointed space segment provider that was not chosen to provide transponder capacity for the subject ESV service, has no incentive in furthering the ESV licensing process. Indeed, such licensing could be held hostage by a space segment provider who could even be attempting to sell space segment capacity to a competing ESV system operator. In addition, after coordination has been concluded, it would be extremely unusual for a satellite operator to approach an adjacent operator for confirmation that certain services were within the coordinated parameters of the satellite. For competitive and other reasons, satellite operators make that judgment individually.

Boeing itself has experienced such difficulties in the context of Commission licensing of its Connexion AMSS operations. For example, Boeing spent many months negotiating with U.S. satellite operators to obtain an agreement to support licensing of its AMSS antennas.³¹ In

³¹ See, e.g., Letter from Philip L. Malet, Counsel for the Boeing Company, to Marlene H. Dortch, FCC, re The Boeing Company Application to Modify Blanket AMSS Earth Station Authorization Call Sign E000723, File No. SES-MOD-20040301-00304 (filed Sep. 1, 2003).

addition, Boeing has experienced outright refusals on the part of foreign space segment providers to re-coordinate with adjacent operators of AMSS operations on the grounds that it is inconsistent with the international coordination process.

Finally, Boeing would note that ESV applications will be placed on public notice for comment. Any interested party, including foreign satellite operators, may review the application and file comments in the proceeding. As a result, there is a transparent and open process for full substantive review of an ESV system's operational parameters and claims of consistency with a serving satellite's coordination agreements.

Thus, a certification from the serving satellite operator should be more than sufficient to establish that the proposed ESV operations are consistent with the satellite's coordinated parameters.

II. THE COMMISSION SHOULD CLARIFY THE CALCULATION OF AGGREGATE OFF-AXIS E.I.R.P. DENSITY OF ESV TRANSMISSIONS

In adopting Ku-band ESV blanket licensing procedures based on off-axis e.i.r.p. density levels, the Commission explained that the values established in new Section 25.222 of the Rules limit emissions from a single transmitter if the selected modulations permit one carrier per channel at the satellite receiver.³² The Commission further stated in the *ESV Order* that if an ESV operator uses a modulation technique such as CDMA that can operate with multiple co-

While Boeing's experience may have been complicated by the unique regulatory status of Ku-band AMSS operations at the time, its experience establishes that any procedural requirement that affords adjacent satellite operators the unilateral ability to block an application by withholding consent – particularly where the proposed operations are consistent with previously coordinated parameters – could place U.S. ESV applicants at undue risk of delay, competitive gamesmanship and other difficulties.

³² *ESV Order* at ¶ 99 n.256.

frequency ESV transmissions to the same satellite, the off-axis e.i.r.p. density limit would be the aggregate power received at the neighboring satellites from all transmissions.³³

However, the actual rule adopted by the Commission is written in terms of a single ESV terminal and contains no explicit provision stating that the off-axis e.i.r.p. density limits are aggregate limits.³⁴ Given the clarity of the Commission's language in the *ESV Order*, it is not clear whether new Section 25.222 must be modified to implement the Commission's intent with respect to aggregate ESV limits. In any event, Boeing seeks clarification in this regard.

Additionally, the Commission should clarify how individual ESV transmissions may be taken into account in meeting the aggregate levels. In its discussion of the Ku-band ESV off-axis e.i.r.p. density limit, the Commission suggests that the calculation methodology discussed in the C-band section of the *ESV Order* is an "example of how an ESV operator might be able to limit [aggregate] off-axis power-density."³⁵ However, the example cited by the Commission appears to require a division of aggregate power density, and thus available data rate capacity, evenly among all simultaneously transmitting terminals (*e.g.*, the off-axis e.i.r.p. density of each of five transmitting ESVs would be limited by the same amount, in this case $10 \cdot \log(5)$ or 7.0 dB).³⁶ Such an approach would preclude a bandwidth-on-demand ESV system, such as that contemplated by Boeing, because it does not account for the varying capacity needs of individual ESV terminals.

³³ *Id.*, ¶ 55 n.154.

³⁴ *Id.* at Appendix B (new Section 25.222).

³⁵ *Id.*, ¶ 99 n.256.

³⁶ *Id.*, ¶ 55 n.154.

Boeing therefore requests that the Commission clarify that the methodology discussed in the *ESV Order* for calculating the aggregate off-axis e.i.r.p. density of simultaneously transmitting ESV terminals is merely an example and that other methodologies are permissible so long as the aggregate levels are satisfied. Clarification of this point is vital to afford ESV systems the operational flexibility needed to implement bandwidth-on-demand systems and dynamically allocate power to individual ESV terminals based on the capacity requirements of those terminals.

III. THE COMMISSION SHOULD MODIFY THE RESPONSE TIME ASSOCIATED WITH TERMINATING ESV TRANSMISSIONS AFTER A TRACKING ACCURACY EXCEEDANCE

The ESV tracking requirement set forth in new Section 25.222(7) should be clarified and revised to reflect tracking technology limitations and current trends in the regulation of ESVs.³⁷ In particular, the 100 millisecond response time to terminate ESV transmissions after a tracking accuracy exceedance may be unrealistic for tracking methods such as “dish scan,” which is the most common tracking method in use for ESVs today. As discussed below, clarification of the requirement and modification of the response time will permit ESV operations consistent with tracking technology limitations and protection of adjacent satellite operations.

In establishing a rational ESV pointing requirement, it is important to understand the distinction between antenna stabilization and tracking. Stabilization is the compensation for rigid body motion of the vessel (yaw, pitch and roll) and vibration, which is generally accomplished using rate gyros that have rapid reaction times (<100 milliseconds). Tracking, on the other hand, is the correction of the difference between the stabilized antenna pointing

³⁷ *ESV Order* at App. B (new Section 25.222(7)) (“All emissions from the ESV shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESV antenna exceeds 0.5°, and transmission will not resume until such angle is less than 0.2°.”).

direction and true direction to the target satellite. Tracking is generally accomplished by moving the antenna beam about the estimated satellite location and using signal strength measurements at different positions to re-estimate the satellite location and correct antenna pointing.³⁸ The rate of the tracking process is limited by the mechanical movement of the antenna about the estimated satellite location. For “dish scan” and other common techniques, the tracking process operates at a frequency of about one cycle per second. In addition, some tracking systems use filtering over several dish scan cycles and so may take up to one to three seconds to detect a tracking error exceedance. The Commission also must be mindful of communications latency between subsystems within an ESV system. For example, it may take several hundred milliseconds for communications between the ESV controller/processor and the antenna subsystem from the time a tracking exceedance is detected to the time a cease transmission command is received and the ESV stops transmitting.

As adopted, the requirement in Section 25.222(7) to automatically cease ESV transmissions is somewhat vague because while it describes the condition for automatic cessation (if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESV antenna exceeds 0.5°), it does not specify the point of reference from which the time permitted for automatic cessation (100 milliseconds) is measured. Given current ESV tracking technology and techniques, Boeing requests that the Commission clarify that the time for automatic cessation of ESV transmissions set forth in Section 25.222(7) is measured from the time of detection of a tracking exceedance. If, however, the Commission concludes that the time for cessation of transmissions must be measured from the time of the actual tracking exceedance, Boeing requests that the time permitted be increased from 100 milliseconds to 3 seconds.

³⁸ This is what the Commission specifies when it refers to “the angle between the orbital location of the target satellite and the axis of the main lobe of the ESV antenna.” *See id.*

Boeing believes that further refinement of the Commission's tracking requirement similar to that adopted by ETSI (discussed below) would permit this longer period for transmission cessation without increasing the potential for interference to adjacent satellites caused by ESV antenna mispointing.

Even if the Commission clarifies the period for automatic cessation of ESV transmissions as requested by Boeing, in view of information processing and intra-system communication latency noted above Boeing also requests that the Commission change the 100 millisecond response time in Section 25.222(7) to 200 milliseconds. This should permit sufficient time for an ESV antenna to receive a cease transmission command and stop transmitting from the time at which a tracking exceedance is detected.

Boeing also notes that the European Telecommunications Standards Institute ("ETSI") working group on ESVs, which Boeing and other ESV proponents participate in, has also been addressing the issue of ESV tracking accuracy. The tracking requirement in Section 4.6.4.2 of Draft ETSI EN 302 420, would require that the ESV manufacturer declare a threshold tracking error ($\delta\phi$) and a response time (T), which may not exceed 5 seconds.³⁹ The ESV is then required

³⁹ See Draft ETSI EN 302 340 V0.11.04 (2004-11) Satellite Earth Stations and Systems (SES); Harmonized EN for satellite Earth Stations on board Vessels (ESVs); operating in the 11/12/14 GHz frequency bands allocated to the Fixed Satellite Service (FSS) covering essential requirements under article 3.2 of the R&TTE directive:

4.2.6.2 Specification...

The terminal shall be able to detect the pointing error. The ESV shall stop transmitting when the instantaneous pointing error exceeds the pointing error threshold, $\delta\phi$, relative to the direction of the wanted satellite at its actual position, declared by the manufacturer within T seconds. The value of T shall be declared by the applicant and shall not exceed 5 s. The ESV shall not resume transmitting until the instantaneous pointing error is within $\delta\phi$ for a period of $2 \times T$ seconds. The applicant may declare ranges of values for $\delta\phi$ as functions of on-axis EIRP spectral density such that the EIRP density limits in 4.2.3.2 are not exceeded.

to detect and respond to a tracking error that exceeds $\delta\phi$ by ceasing transmissions within T seconds. The ESV may not resume transmitting until the tracking error remains within the threshold for twice T seconds. This penalty encourages manufacturers to design ESVs with the fastest possible detection and response times. Similarly, in section 4.2.3.2 of Draft ETSI EN 302 420, tracking error threshold, $\delta\phi$, is incorporated into the off-axis e.i.r.p. requirement such that the off-axis mask is lowered in proportion to $\delta\phi$. This ensures that the off-axis mask will always for tracking errors less than $\delta\phi$ and it encourages manufacturers to design ESVs with the smallest possible tracking error. These requirements promote the lowest possible tracking error and detection and response time without mandating specific parameters, while at the same time providing the necessary protection for adjacent satellites. Boeing respectfully requests that the Commission consider incorporating similar flexibility into its tracking requirement.

4.2.3.2 Specification...

The maximum EIRP in any 40 kHz band within the nominated bandwidth of the co-polarized component in any direction ϕ degrees from the antenna main beam axis shall not exceed the following limits:

$33 - 25 \log (\phi + \delta\phi) - \text{HdBW}$	for	$\phi_{\min} \leq \phi + \delta\phi$	\leq	$7,0^\circ$;
$+12 - \text{H dBW}$	for	$7,0^\circ < \phi + \delta\phi$	\leq	$9,2^\circ$;
$36 - 25 \log (\phi + \delta\phi) - \text{H dBW}$	for	$9,2^\circ < \phi + \delta\phi$	\leq	48° ;
$- 6 - \text{H dBW}$	for	$\phi + \delta\phi$	$>$	48° .

where:

- ϕ is the angle, in degrees, between the main beam axis and the direction considered; and
- $\delta\phi$ is the pointing error threshold, in degrees, as declared by the applicant (see clause 4.2.6.2).

IV. THE COMMISSION SHOULD ESTABLISH A KU-BAND MINIMUM DISTANCE AND APPLICABLE FREQUENCY BANDS FOR PRIOR AGREEMENT CONSISTENT WITH RESOLUTION 902

Resolution 902 provides that “[a]ny transmissions from ESVs within the minimum distances shall be subject to the prior agreement of the concerned administration(s).”⁴⁰ In the *ESV Order*, the Commission stated that it will permit both C-band and Ku-band ESVs to operate on foreign-registered vessels using hubs located outside of the United States within 300 km of the U.S. coastline under certain conditions, including where there is a bilateral ESV agreement between the United States and the foreign administration in which the hub is located.⁴¹ The establishment of a uniform 300 km distance for both C- and Ku-band ESV operations and requiring prior agreement throughout the 14.0-14.5 GHz band for foreign Ku-band ESV operations appear to be inconsistent with Resolution 902.

Boeing can find no basis in Resolution 902 or other international requirements to warrant prior agreement for foreign Ku-band ESV operations beyond 125 km of the U.S. coastline.⁴² On the other hand, the rules adopted by the Commission require coordination with U.S. government stations in the 14.0-14.2 GHz and 14.47-14.5 GHz band only when Ku-band ESVs seek to

⁴⁰ Resolution 902 (Geneva, 2003), Annex 1.

⁴¹ *ESV Order* at ¶ 127-28. The Commission also indicated that it will actively engage in negotiations to conclude bilateral agreements with foreign administrations that authorize ESV operations under Article 4.4 that are conducted within 300 km of the United States to ensure that such operations are consistent with U.S. ESV requirements. *Id.*, ¶ 128. Boeing would note that in many cases it is a vessel’s registering or “flag” administration, rather than the administration in which a hub earth station is located, that would be the appropriate administration with which to conclude a bilateral ESV agreement because the flag administration is generally responsible for radio station operations on board its vessels. For example, an ESV operator may simply lease a previously authorized FSS earth station facility for use as a hub, and the administration in which the hub is located may be unaware of such use and may not have even examined the technical characteristics of the ESV system as a whole.

⁴² The 300 km distance suggested by the Commission appears to be based on the minimum distance for C-band ESVs set forth in Resolution 902.

operate within 125 km of U.S. government facilities,⁴³ which is consistent with Resolution 902's minimum distance.

Boeing believes that it would be inappropriate for any administration, including the United States, to seek prior agreement for foreign Ku-band ESV operations beyond the 125 km minimum distance set forth in Resolution 902. As a U.S. ESV licensee, Boeing fully intends to comply with all of the Commission's rules for ESV operations; however, it is concerned that a precedent of extending the requirements for prior agreement beyond the 125 km minimum distance for Ku-band operations could have a substantial adverse impact on U.S. ESV operators around the world. In particular, other administrations may similarly seek to extend their reach beyond the internationally established minimum distance within which prior agreement for foreign ESV operations is necessary. Such a decision could also have unintended consequences in unrelated areas where issues of extra-territorial jurisdiction arise. For these reasons, and because the Commission's substantive requirements for Ku-band ESV coordination are limited to within 125 km from U.S. government facilities, Boeing urges the Commission to adopt uniformly the 125 km distance set forth in Resolution 902 for the Ku-band as the distance within which foreign ESV operations must be conducted pursuant to a bilateral agreement with the United States.

Similar reasoning applies to the Commission's decision to require prior agreement for Ku-band ESV operations within the entire 14.0-14.5 GHz band. Although the *ESV Order* suggests that the United States is a concerned administration for the 14.0-14.5 GHz band,⁴⁴ the

⁴³ See *id.*, ¶¶ 89-92, 95-97; see also *id.* at Appendix B (new Section 25.222 (d)-(e)).

⁴⁴ *ESV Order* at ¶ 128, n.330 (“We noted under Resolution 902, Annex 1 ‘[a]ny transmission from ESVs within the minimum distances shall be subject to the prior agreement of the concerned administrations,’ and that the United States is a concerned administration in the 5925-6425 MHz and 14.0-14.5 GHz Bands.”).

international Radio Regulations designate the United States as a concerned administration only with respect to the 14.4-14.5 GHz band.⁴⁵ As a result, there does not appear to be any basis in the international Radio Regulations or Resolution 902 for the Commission to require prior agreement with foreign administrations to permit ESVs to operate in the 14.0-14.4 GHz band.⁴⁶ Boeing respectfully requests that the Commission clarify its decision with respect to this issue.

⁴⁵ See Resolution 902 (2003, Geneva) at Annex 1:

Frequency bands	Potentially concerned administrations
5 925-6 425 MHz	All three Regions
14-14.25 GHz	Countries listed in No. 5.505 , except those listed in No. 5.506B
14.25-14.3 GHz	Countries listed in Nos. 5.505 , 5.508 and 5.509 , except those listed in No. 5. 506B
14.3-14.4 GHz	Regions 1 and 3, except countries listed in No. 5. 506B
14.4-14.5 GHz	All three Regions, except countries listed in No. 5. 506B

The United States is not included in the referenced country footnotes for the 14.0-14.3 GHz bands, and as a Region 2 country is not a potentially concerned administration for the 14.3-14.4 GHz band either.

⁴⁶ Boeing recognizes that the Commission has a significant interest in protecting the operations of U.S. government stations in the 14.0-14.2 GHz band and U.S.-licensed Ku-band satellite operations throughout the 14.0-14.5 GHz band, and that Sections 301 and 306 of the Communications Act provide the Commission the authority and responsibility to protect U.S.-licensed radio communications systems from harmful interference. Thus, there may be a basis in the Communications Act to require foreign ESVs operating in the Ku-band to comply with coordination requirements similar to those imposed on U.S. ESV licensees, but without requiring the prior agreement of other administrations.

V. CONCLUSION

For all of the foregoing reasons, Boeing respectfully requests that the Commission clarify and/or reconsider its *ESV Order* with respect to the issues discussed herein.

Respectfully Submitted,

/s/

R. Craig Holman
Counsel
The Boeing Company
Connexion by Boeing
P.O. Box 3707, MC 14-07
Seattle, WA 98124-2207
(206) 655-5399

Philip L. Malet
Carlos M. Nalda
Lee C. Milstein
Steptoe & Johnson LLP
1330 Connecticut Avenue, NW
Washington, DC 20036
(202) 429-3000
Counsel for The Boeing Company

Dated: March 2, 2005